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EXECUTIVE SUMMARY OF THE
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FINLAND

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United Nations Framework Convention on Climate Change

In accordance with decision 9/2 of the Intergovernmental Negotiating Committee of the Framework Convention on Climate Change (INC/FCCC), the interim secretariat is to make available, in the official languages of the United Nations, the executive summaries of the national communications submitted by Annex I Parties.

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Finland and the greenhouse effect

1. Finland is an industrialized country with a great deal of forest. Because of the structure of industry and the country's geophysical conditions, large amounts of energy are consumed. In 1990, $C0_2$ emissions from fossil fuels and peat and from industry totalled 54 million tonnes. Wood burning released another 17 million tonnes of $C0_2$, but this is not counted in total emissions because even more carbon was bound up in growing stock in the forests. Methane (CH_4) emissions totalled 252,000 tonnes, nitrous oxide (N_20) 23,000 tonnes, nitrogen oxides 295,000 tonnes of nitrogen dioxide, carbon monoxide (CO) 487,000 tonnes and volatile organic compounds from human activities (NMVOC) 219,000 tonnes. Emissions other than carbon dioxide were jointly equivalent to some 29 million tonnes of $C0_2$ in terms of their greenhouse effect.

Finland's climate strategy

2. The main focus in Finland's climate strategy is to intensify those programmes to reduce greenhouse gas emissions that are already under way, such as efficiency improvements in the energy production and utilization system, and use of energy and carbon taxes. As well as limiting emissions of $C0_2$ and other greenhouse gases, the Finnish action programme also includes measures to enhance carbon reservoirs and sinks. In its energy report to Parliament in autumn 1993, the Government adopted the goals of halting growth in $C0_2$ emissions from energy production and use at the end of the '90s. Finland has been practising sustainable forestry for decades now, and consequently the forests are expected to sequester increasing amounts of atmospheric carbon for at least the next 15-20 years. In 1994, the Government ratified a forestry environment programme concentrating on protecting the biodiversity of the forest ecosystem. This means that even more carbon will be bound in the forests.

3. In line with the Convention on Climate Change, Finland is taking action to mitigate climate change by limiting emissions of greenhouse gases and enhancing sinks and reservoirs. The country's potential for doing this is limited by its special geographical and economic conditions, which should be taken into account according to the Convention. Also instrumental here is how extensively other industrialized countries are willing to take action to mitigate climate change. Finland will work with other countries to promote the widespread adoption of measures to this end, with the maintenance of sustainable and balanced economic development as the goal.

Carbon dioxide emissions from energy production and consumption, and industry in 1990

4. In 1990, $C0_2$ emissions from Finnish energy production and consumption and industry, estimated according to the Intergovernmental Panel on Climate Change (IPCC) reporting instructions, totalled some 54 million tonnes. Most of these emissions derived in various ways from energy production and consumption. Emissions from industrial processes, mainly from the cement and lime industry, totalled 1.2 million tonnes.

5. Other activities connected with energy production, but whose emissions are not counted in the CO_2 total, are bunkers, use of wood-based fuels, and emissions equivalent to imported electricity. Finland has so far imported over 10 per cent of the electricity it needs from neighbouring countries. The CO_2 emissions of bunkers totalled 2.8 million tonnes. Some 17 million tonnes derived from the use of wood-based fuels. In 1990, net imports of electricity accounted for 17 per cent of total consumption of electricity, which would have caused some 11 million tonnes of CO_2 emissions if it had been generated by Finnish condensing power.

CO_2 emissions from Finnish energy production and consumption and industry, 1990

Source	Emissions in 1990 million tonnes of CO_2
Fossil fuels and peat	53
Industrial processes	1.2
Bunkers	2.8
Wood-based fuels	17
Emissions equivalent to imported electricity	11

6. Finnish industrial output rose by a third between 1980 and 1990. During the same period, however, fuel consumption only increased about 10 per cent. In terms of CO_2 emissions, it was beneficial that the increase in fuel consumption stemmed mainly from wider use of natural gas and wood-based fuels. Today's nuclear power capacity came fully on stream in the '80s, and by 1990 accounted for a third of total electricity production. Oil consumption by industry halved during the '80s, and emissions from industry and energy production at the end of the decade were nearly the same as ten years earlier, though the economy and energy consumption had grown.

7. CO_2 emissions from domestic traffic rose from 8.4 million tonnes to 11.5 million between 1980 and 1990, largely as a result of the increase in passenger and goods traffic consequent to fast economic growth (nearly 40 per cent in 1980-1990). Judged in passenger kilometres, traffic increased 30 per cent in the '80s. During the same period, distances travelled by lorries rose 16 per cent.

Biospheric carbon reservoirs and sinks

8. The forests are Finland's most important natural resource. Of the total land area, 76 per cent is classified as forested. The forests have been managed according to sustainable principles for several decades now, so felling has never exceeded forest growth. As a result, growing stocks in the forest have been rising ever since the '60s. The forests and the timber resources in them are still increasing substantially, thanks to their age structure and efficient silviculture. At the moment, the volume of growing stock in Finland is 1,880 million cubic metres, and the amount of carbon bound up in the forests continues to grow, since the overall amount harvested each year is very much lower than the increment.

9. According to the current forestry environmental programme, an annual increment of some 5-10 million cubic metres is estimated to be untouched by commercial exploitation, as a result of environmental protection goals such as the conservation of biodiversity. In 1990, the Finnish forest ecosystem had stored 2,700 million tonnes of carbon, with trees -- including branches and roots -- accounting for 660 million tonnes. The forest carbon dioxide sink in 1990 is put at around 31 million tonnes of $C0_2$.

10. Finland also has huge areas of peatland and mire. The carbon stored in the peat is put at 6,300 million tonnes. Virgin mires are estimated to accumulate 0.4-2.0 million further tonnes of carbon every year. Of the country's original ten million hectares of peatland, some six million have been drained for forestry and farming. The result of drainage is that the peat starts to disintegrate, causing carbon dioxide to be released into the atmosphere. In most of the areas drained, tree growth has improved and carbon absorption has increased, a fact partly reflected in rising forest resource figures. Over about 10 per cent of the drained areas, drainage has not yielded the desired increase in forest growth, however, and because of peat disintegration they have become sources of carbon dioxide. The net emission from these non-viable forest drainage areas is put at 1-5 million tonnes of $C0_2$.

11. Peatlands drained for agricultural use have also started to witness peat disintegration not counterbalanced by carbon binding in growing plants; this, too, is a $C0_2$ source. The annual $C0_2$ emission from cultivated peatlands is put at 3-10 million tonnes. The above estimates concerning the carbon balance of the peatlands are still rather unreliable, however.

Structure of Finnish energy production

12. Finland's energy production system is diversified and utilizes several energy sources. This reduces the economy's tolerance to problems caused by sudden fluctuations in the price or availability of individual fuels. The most important domestic energy sources are hydro power and biomass, that is, pulp and paper industry wood waste. This latter accounts for 13 per cent of all use of primary energy.

13. Over 30 per cent of Finland's electricity is produced in combined heat and power (CHP) systems, that is, either district heating plants or industrial back pressure utilities. At such installations, 80-90 per cent of fuel energy is exploited, compared with about 40 per cent at condensing power plants. The potential for district heat production combined with electricity and the coverage of the district heating network is already fully utilized. Specific releases of $C0_2$ from the energy system are therefore already low, at around 42 g $C0_2$/MJ. About half of the electricity need is met by hydro and nuclear power. Only 11 per cent of the electricity consumed in 1990 was generated at coal-fired condensing power plants.

Energy policy

14. Finland has a long history of measures to save energy and make use of energy more efficient, and several energy reports and programmes have been drawn up since 1973. This action was largely motivated by purely economic reasons.

15. Because of the cold climate, buildings have always been designed and constructed partly with energy economy in mind. Really effective forms of insulation were introduced in the '60s and triple glazing, for instance, was made compulsory in all new buildings as early as the 70s. Official regulations, energy counselling and financial incentives have succeeded in reducing building-specific heat consumption to the level found in many countries that are very much warmer than Finland. This past action has thus reduced the number of cost-effective options open in the future.

16. The autumn 1993 Council to State Report to Parliament on Energy Policy aimed to ensure social and economic development and achieve a reduction in harmful environmental effects, while also reconciling energy targets and economic and environmental goals.

17. As early as 1990, Finland became the first country in the world to introduce a $C0_2$ tax. Since the beginning of 1994 fuel has been taxed partly on environmental grounds in that a tax on energy content was levied on all primary energy sources. A tax on carbon content is also levied on fossil fuels. This change in the tax structure favours low-emission energy sources, promotes energy conservation and encourages the use of renewable fuels such as biomass to replace fossil fuels. Over the short term the impact is relatively slight, but because the new tax system is meant to be permanent, it already influences decisions on investments and will thus gradually affect the structure of production and consumption. According to the 1995 budget bill, revenues from the tax based on carbon and energy content will contribute 0.5 per cent to gross domestic product (GDP). Any chance of raising the tax rate will also depend on international progress in introducing the tax.

18. In autumn 1992, the Government approved a separate energy conservation programme aimed at rationalizing end uses of energy in individual sectors by cutting 1990 level specific consumption 10-15 per cent by the year 2005, that is, space heating 10 per cent, household use 15 per cent, services 15 per cent and industry 10 per cent. The Government has launched work to revise the energy conservation programme in 1995.

19. Research on energy conservation has continued. Improved energy surveys and investment in economy measures have been supported. A special service centre to promote energy conservation, called MOTIVA; has been set up for information purposes. A separate energy conservation programme has been drawn up for the public sector. Voluntary energy conservation agreements have been concluded between the government and industry. In spring 1994, as one element in the programmes called for by its energy report, the Government decided on measures to encourage the use of biofuels. The aim is for use of bioenergy to increase at least 25 per cent by the year 2005. The goal set by the Government means expanding use of biofuels by 1.5 million tonnes of oil equivalent (Mtoe) by that date. Half of this target will be achieved by further use of peat and half by using wood from the forests.

20. To ensure that the structure of energy production remains diversified and based on both new technologies and renewable energy sources, the Government has been putting more money into the development of Finnish energy technology, and launching, financing and

directing research programmes and development and demonstration projects for the home market and for export. This has been going on for several years now, and in 1993 the Ministry of Trade and Industry launched new energy technology development programmes ranging up to 1998.

Transport and communications

21. Greenhouse gas emissions from transport and communications are relatively high, because the population is scattered and distances are great. Since 1990, a rapid decline in emissions of nitrogen oxide, hydrocarbons and carbon monoxide from traffic has been achieved through technical improvements and granting a tax relief on cars with catalytic converters. Exhaust gas emissions from lorries and buses have been reduced, for example, by cutting the maximum level of nitrogen oxides by half compared with the end of the '80s, and by ordering heavy vehicles to carry a speed limitation device that prevents excessively high speeds.

22. The tax on car purchases has always been rather high by international standards, a fact that has curbed growth in the car stock and especially discouraged the purchase of powerful cars. The tax on traffic fuels has also been raised sharply, and this, combined with the recession in the early '90s, has caused a halt in traffic growth. There has been a change over to unleaded reformulated gasoline because of the steeply graded fuel tax, and this has reduced emissions of carbon monoxide and hydrocarbons by 10-15 per cent.

23. Other measures adopted include subsidies for public transport (though these subsidies have had to be cut substantially in recent years), investments in the rail network and in electrification, a cut in the right to tax-deduct business travel costs, and a reduction in the transport subsidy to industry in developing areas. Use of gas fuels, bioalcohols and rapeseed methyl esters as traffic fuels has been studied and vehicles developed as far as the production stage.

24. The Ministry of Transport and Communications has drawn up an action programme of long-range targets and action proposals for reducing the environmental hazards of traffic. The bodies responsible for the programme are the Ministry and the administrative units and public enterprises subordinate to it, the other ministries, the local authorities, companies and organizations. Implementation of the programme is largely voluntary. The Government decision-in-principle in 1993 on measures to promote traffic safety includes steps in line with the action programme, aimed, for instance, at restraining further traffic growth.

25. Plans for future action are largely targeted at road traffic and a reduction in volumes. Emissions from new working machinery and rail diesels are also being reduced, as are nitrogen oxide emissions from ship engines, through international cooperation. The possible introduction of landing charges for aircraft, graded according to their environmental impact, is also being investigated.

Agriculture

26. Methane emissions from agriculture derive from the digestive processes and manure of domestic animals, and totalled 94,000 tonnes in 1990. The use of chemical fertilizers and manure spreading and, to a lesser degree, the spreading of treatment plant sludge on fields also cause nitrous oxide emissions, totalling 12,000 tonnes in 1990. Reducing these emissions is a key element in action to cut the load on the water system caused by farming. Improvements to cowsheds and manure containers and better manure handling procedures have succeeded in reducing methane emissions somewhat.

27. The Rural Environment Programme approved in 1992 and the agri-environmental support programme which is an element in Finnish accession to the European Union both include action to reduce greenhouse gas emissions from farming and greenhouse cultivation. It is difficult to predict the changes that will take place in farming and in the number of livestock, but emission estimates assume that there will be no major changes in the next few years.

28. Closer checks on and reduction in the use of chemical fertilizers and checks on the use of manure will help stabilize nitrous oxide emissions. The clear increase in grass cultivation will act in the same direction. More effective water pollution controls in animal husbandry, combined with the agri-environmental support programme, will also bring a decline in overall emissions of methane.

Waste management

29. In Finland, as in most other industrial countries, waste water is mainly treated aerobically, resulting in low methane emissions. The annual estimate is about 7,000 tonnes. Emissions from industrial effluent in 1990 are put at about 27,000 tonnes.

30. In 1990, Finland had 680 landfills, and some 1,000 have been closed. The waste management development programme calls for a substantial decrease in the number of landfills; the aim is for only 200 by the year 2000. Reducing the number will make for more efficient management and supervision, and also reduce their harmful environmental effects.

31. Methane emissions from landfills will decrease substantially in the near future. In the year 2000, emissions are expected to be about 60,000 tonnes, compared with 105,000 in 1990. A few landfills already recover the methane released and use it as a fuel for small-scale energy production.

International cooperation

32. Finland took an active part in the United Nations Conference on Environment and Development and provides financial support for programmes contributing to sustainable development. Finland assists developing countries in furthering the goals of the Framework

Convention on Climate Change through bilateral and multilateral aid programmes that support countries in adopting advanced environmental technology, in increasing general know-how and capacity concerning environmental protection, and in the maintenance of greenhouse gas reservoirs and sinks, especially forests. In 1994-1996 Finland is contributing FIM 105 million to the Global Environment Facility in compliance with the agreed burden-sharing. Environmental cooperation with countries in economic transition also began recently.

Research on climate change

33. In 1990-1995, the Finnish government will be contributing altogether FIM 90 million or so to the research programme on climate change (SILMU), which includes some 60 research projects and two hundred research workers. The main areas being studied are climate changes expected in Finland, assessment of the effects of climate change on the ecosystem, and strategies for adapting to and combating these effects. The programme focuses on special issues of importance to Finland, such as the carbon balance of the peatlands and adjustment of the forest ecosystem to changes in climate. Basic research on climate change connected with international programmes such as the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP) is also included.

Trends in emissions and sinks, 1990-2010

34. Carbon dioxide emissions from energy production and consumption can be limited in future through the measures outlined above. Even so, emissions will probably rise between 1990 and 2000, partly because it is assumed that all the electricity used in Finland in future will also be produced here. In 1990, $C0_2$ emission equivalent to electricity imports was 11 million tonnes. $C0_2$ emissions from industrial processes are not expected to change very radically in future.

35. Estimates of emissions from the biosphere are still very unreliable, but the $C0_2$ emissions produced as a result of peat disintegration in cultivated peatlands and non-viable drainage areas will presumably decrease in future. There are no grounds at present for maintaining non-viable drainage areas in a condition fit for forest cultivation, and it would be more practicable to let them run wild. Similarly, the area covered by cultivated peatlands is declining rapidly as a result of reforestation or return to the natural state, and consequently their $C0_2$ emissions are decreasing.

Finnish $C0_2$ emissions in 1990 and estimates for 2000 and 2010

Source	Emissions in 1990 mill. tonnes CO_2	Estimate for 2000 mill. tonnes CO_2	Estimate for 2010 mill. tonnes CO_2
Fossil fuels and peat	53	69	69
Industrial processes	1.2	1.2	1.2
Cultivated peatlands	3-10	1-3	1-3
Non-viable drainage areas	1-5	0-3	0
Total	58-69	71-76	71-73
Emissions equivalent to electricity imports	11	-	-
Total	69-80	71-76	71-73

36. Emissions of methane, nitrogen oxides, carbon monoxide and NMVOCs will decline in future in all probability. Methane emissions from landfills, energy production and traffic will decrease in these sectors merely because of qualitative and technical changes already implemented. Emissions of nitrogen oxides will decline substantially, particularly because of action to limit emissions in energy production and in transport and communications. Carbon monoxide emissions and emissions of NMVOCs will mainly decrease because of lower emissions from road transport. In contrast, emissions of nitrous oxide are likely to increase, primarily because of higher emissions from energy production and traffic, unless radical advances are made in technical means of cutting emissions in these sectors.

Finnish emissions of greenhouse gases in tonnes of $C0_2$ equivalent in 1990, and estimates for 2000 and 2010

Gas	Global Warming Potential integrated over 100 years	Emissions in 1990 CO_2 Equivalent Mt	Emission estimates in 2000 CO_2 Equivalent MT	Emission estimates in 2010 CO_2 Equivalent Mt
CO_2	1	58-69	71-76	71-73
CH_4	24.5	6.2	5.0	4.9
N_2O	320	7.4	9.0	9.3
NOx	40	11.8	9.1	8.0
CO	3	1.5	1.0	0.9
NMVOC	11	2.4	1.5	1.5
Total		87-98	97-102	96-98

37. Over the decades, increasing amounts of carbon from the atmosphere have been absorbed in the Finnish forests. The net forest sink in 1990 is put at 31 million tonnes of CO_2. In future, developments will depend on how much wood is used. It is assumed that forest industry wood utilization will continue to increase (from 50 million cubic metres in 1990 to about 56 million in 2000), giving an annual CO_2 sink of about 23 million tonnes in 2000. However, the amount of carbon bound up in stemwood, branches and roots in 2000 and 2010 in the scenario based on increasing wood utilization has also grown appreciably on the 1990 level.

Carbon balance and reservoir in total wood biomass in managed forests in 1970, 1980 and 1990, and estimates for 2000 and 2010. The estimates are based on the scenario of increasing wood utilization.

	Million tonnes of CO_2				
	1970	1980	1990	2000	2010
Carbon sequestration	76	91	103	114	121
Carbon emission	75	65	72	91	97
Annual sink	2	26	31	23	23
Carbon reservoir	1940	2141	2420	2633	2842

38. Economic growth will increase Finnish energy consumption in the 1990s despite the Governments energy conservation programme, because most of the production plants and processes, buildings, vehicles, machinery and equipment in use and under construction today will still be in use in the year 2000. The rate of replacement is insufficient for the reduction in specific consumption achieved thereby to counteract the effects of overall expansion on energy consumption.

39. In 2000, most CO_2 emissions will be from installations already in use or under construction. Parliament has rejected the application to build a fifth nuclear power plant and has also passed a Rapids Protection Act, so there win be no chance to achieve appreciable structural changes in the energy production system by 2000. Instead, today's substantial imports of electricity will have to be replaced by conventional domestic electricity production. Any fast increase in the amount of natural gas used and the creation of a new pipeline link from the west also depend on decisions in countries other than Finland. In practice, getting new energy production methods operational, thereby substantially improving the efficiency of electricity production and at the same time also making effective use of renewable biofuels using these methods, will only be possible on any major scale after the year 2000. Achieving a reduction in emissions larger or faster than outlined above, and continuing to reduce emissions in the long term call for several simultaneous additional

measures and a consistent strategy. The Government has already launched a reassessment of the energy conservation programme in which even finer action, including official regulation, non-statutory norms and standards, will be pondered. The new programme should be approved in 1995.

40. Developments in industry and communities, faster-than-expected advances in technology and changes in attitudes to energy use, together with progress internationally, may all create the future potential for new ways of reducing emissions. Better knowledge about the effects of human activities on biospheric greenhouse gas balances may also yield new approaches, for example, in agriculture and forestry and in land use. Effective combating of climate change calls for decades of work and successful measures to implement the strategy. The need for new action must thus be constantly reassessed.